

ABSTRACT

This invention is directed to a downhole method and apparatus for simultaneously determining the horizontal resistivity, vertical resistivity, and relative dip angle for anisotropic earth formations. The present invention accomplishes this objective by using an antenna configuration in which a transmitter antenna and a receiver antenna are oriented in non-parallel planes such that the vertical resistivity and the relative dip angle are decoupled. Preferably, either the transmitter or the receiver is mounted in a conventional orientation in a first plane that is normal to the tool axis, and the other antenna is mounted in a second plane that is not parallel to the first plane. This invention also relates to a method and apparatus for steering a downhole tool during a drilling operation in order to maintain the borehole within a desired earth formation. The steering capability is enabled by computing the difference or the ratio of the phase-based or amplitude-based responses of the receiver antennas which are mounted in planes that are not parallel to the planes of the transmitter antennas. Although this invention is primarily intended for MWD or LWD applications, this invention is also applicable to wireline and possibly other applications.